UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/052,347	01/23/2002	Katsuhide Manabe	P 282475 F00-219-USdiv3-c	4113

7590 03/10/2005

Sean M McGinn
McGinn & Gibb PLLC
8321 Old Courthouse Road
Suite 200
Vienna, VA 22182-3817

EXAMINER	
MULPURI, SAVITRI	

ART UNIT	PAPER NUMBER
2812	

DATE MAILED: 03/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/052,347	MANABE ET AL.	
	Examiner	Art Unit	
	Savitri Mulpuri	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 2//24/2005.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 19-52 and 119-131 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 19-52,119-131 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/24/2005 has been entered.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 19-52,119-131 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sayyah (Doctoral Dissertation presented in Feb.1986) in combination with in combination with Admitted prior art.

Sayyah discloses a method for producing a gallium nitride group compound semiconductor by MOCVD technique(see page 21, section 2.1 and 2.2.5): setting a mixing ratio of silicon-containing gas to at least one other raw material gas (SiH_4/ TMG+TMA) during vapor phase epitaxy at a range over which a conductivity of gallium nitride group compound semiconductor increases substantially proportionally with said

mixing ration so as to obtain a desired conductivity as in claim 19 or concentration as in claim 20 of the gallium nitride group compound semiconductor, forming gallium nitride group nitride group compound semiconductor by feeding silicon containing gas and other raw material gas at mixing ratio, wherein the gallium nitride group compound semiconductor comprises $Al_xGa_{1-x}N$ or GaN with concentration of $1 \times 10^{17} / cm^3$ to $1 \times 10^{19} / cm^3$. Page 125, first paragraph and table 14; fig.32 and related description). Sayyah clearly shows silicon concentration increases with increasing ratio of silane to mixture of TMG and TMA (see the plot fig. 32) and increase in silicon concentration increases the conductivity because conductivity is mobility of carriers times concentration. With respect to claims 28-30,34-36. Sayyah discloses electron concentration not less than $1 \times 10^{16} / cm^3$ in the range of $1 \times 10^{17} / cm^3$ -$1 \times 10^{19} / cm^3$ depending on mole fraction as similar to instant claims(see page 37). With respect to claims 25-27,31-36, it is inherent in the invention of sayyah, the conductivity is similar because concentration of silicon in GaN based layer and growth technique to grow GaN based layer are similar in both instant invention and in the invention of Sayyah, wherein conductivity is carrier mobility times the concentration of silicon.

All claims call for gallium nitride group compound semiconductor except claims 22,23, where gallium nitride group compound semiconductor is specifically GaN. Sayyah et al , section 2.6.3 teaches GaN layer grown by MOCVD, when x = 0, electron concentration is $10^{19} - 10^{20} cm^{-3}$, which is within claimed limits (see section 2.6.3, last para).

Though, Sayyah teaches growing GaN based layer at temperature as low as 500 C, but does not specifically mention growing GaN based layer on a gallium nitride based buffer layer, wherein buffer layer is grown at a temperature lower than GaN layer growth temperature. Admitted prior art teaches GaN layer grows directly on sapphire substrate or buffer layer of aluminum nitride. However such low temperature buffer layer growth is obvious because low temperature growth buffer layer inhibits the creation of defects or dislocations in the GaN layer to be grown on buffer layer.

Sayyah does not teach forming second gallium nitride layer with resistively greater than the resistivity in first gallium nitride layer, wherein second gallium nitride is formed without feeding silicon-containing gas. However, admitted prior art , at page 1-2, teaches forming I-GaN layer(with no silicon) on n-GaN layer (silicon –containing layer) to form light emitting diodes to improve luminous intensity (see page 2, first paragraph). It would have been obvious to form I-GaN layer to improve light efficiency.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 19-52,119-131 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-24 of U.S. Patent No. 6,362,017 in view of Admitted Prior Art. The scope instant claims are substantially same as instant claims except "forming second gallium nitride layer with resistivity greater than the resistivity in first gallium nitride layer, without feeding silicon-containing gas". However, admitted prior art , at page 1-2, art teaches forming I-GaN layer on n-GaN layer to form light emitting diodes to improve luminous intensity (see page 2, first paragraph). It would have been obvious to form I-GaN layer to improve light efficiency. Instant claims call "a method of for producing a gallium nitride compound semiconductor" and where as patented claims call "a method of for producing a gallium nitride compound semiconductor satisfying the formula $Al_x Ga_{1-x}N$, $0 \leq x \leq 1$, wherein when x is zero the layer is GaN layer.

Response to Arguments

Applicant's arguments filed 2/24/2005 have been fully considered but they are not persuasive. Applicant's arguments the Sayyah does not teach amended limitation ""forming second gallium nitride layer with resistivity greater than the resistivity in first gallium nitride layer, without feeding silicon-containing gas". However, the modified invention would have such limitation to improve the luminous intensity of the optoelectronic device like light emitting devices.

Applicant argues at pages 3-5, that conductivity is never changed by Si doping and electron concentration never increased in Sayyah. However Sayyah teaches Si dopant concentration is linearly proportional to the ratio of silicon to total of TMG and TMA (see page 134 and figure 32). In sayyah electron concentration can be calculated by the conductivity, which is dependent on dopant concentration. In next communication, Applicant must provide proof to support to applicant's argument that electron concentration does not increase even when Si concentration increases in Sayyah reference. All claims call for gallium nitride group compound semiconductor except claims 22,23, where gallium nitride group compound semiconductor is specifically GaN. Sayyah et al , section 2.6.3 teaches GaN layer grown by MOCVD, when x = 0, electron concentration is $10^{19} - 10^{20}\,cm^{-3}$, which is within claimed limits (see page 37 section 2.6.3, last para).

Applicant argues that there is no motivation to combine sayyah with teachings of admitted prior art of growing GaN directly on sapphire or on buffer layer formed on substrate. However, growing buffer layer first and then followed by GaN doped layer reduces dislocation or defects, which otherwise present due to mismatch of sapphire and gallium nitride based semiconductors. Moreover, admitted prior art teaches art recognized equivalence of growing GaN directly on sapphire or on buffer layer, which does not require motivation to combine (see page 1, last paragraph).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Savitri Mulpuri whose telephone number is 571-272-1677. The examiner can normally be reached on Mon-Fri from 8 a.m. to 4.30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt, can be reached on 571-272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Savitri Mulpuri
Primary Examiner
Art Unit 2812